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Possible Paleopathological Evidence of Treponematosis From a Megalithic Site at Agripalle, India

V.V. RAO, T.S. VASULU, AND A.D.W. RECTOR BABU
3-4-16, Narasingharaopeta, Ankapalle-531001, A.P., India (V.V.R.); AHGU, Indian Statistical Institute, Calcutta 700 035, India; and Department of Anthropology, University of Kansas, Lawrence, KS 66045

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ABSTRACT An Iron Age (megalithic) skull recovered from a cist burial complex at Agripalle, Andhra Pradesh, India, exhibits extensive erosion of the calvarium, areas of sclerotic diploe, irregular osteitic and periosteitic lesions, and deep ulcerations with a granulomatous appearance of nodular foci due to bone remodeling. These lesions are found over the entire surface, but are less severe in the temporal region and in the occipital region below lambda. There is extensive ulceration and destruction of the orbital roof and the nasopalatine region. A thick bony mass representing a healed lesion is present on the nasal margin. Comparison with the pathologic skeletal series of Ortner and Putschar ([1981] Smithson. Contrib. Anthropol. *28:*180–218), Steinbock ([1976] Paleopathology: Diagnosis and Interpretation, pp. 86–169), and Calvin ([1964] Bones and Disease: Evidence of Disease and Abnormality in Early Man) indicates that these findings warrant a diagnosis of an advanced stage of treponematosis. The material from Agripalle, together with similar specimens recovered from the sites of Bhimbetka (Iron Age) and Inamgaon (Chalcolithic), furnish additional evidence supporting the hypothesis of the prehistoric antiquity of treponemal disease in both the New and Old Worlds.

The origin and antiquity of treponematosis are a matter of controversy. The abundant skeletal and epidemiological evidence for its pre-Columbian presence in New World argues for an American origin, whereas the Old World evidence is scanty and sporadic. It has been suggested that treponemal disease was present in the pre-Columbian Old World, but only in a mild, endemic form, not virulent enough to produce many recognizable skeletal lesions (Hackett, 1963). The scanty pre-Columbian evidence for treponematosis in the Old World is mostly limited to Europe, though possible cases have also been reported from Asia and other regions (Drusini, 1988; Baker and Armelagos, 1988; Brothwell, 1988). This limited distribution may reflect only the relative lack of research in Asia and Africa. Paleopathological studies are few and relatively recent in southeast Asia (Lukacs, 1981, 1992; Lukacs et al., 1986; Kennedy, 1984, 1990; Rao and Vasulu, 1985). Of the 287 prehistoric sites known from this region, human skeletal remains have been reported from only 63, and few have been subjected to systematic paleopathological investigation (Kennedy and Caldwell, 1984; Vasulu, 1993). Studies of the remains from these sites can be expected to yield crucial evidence bearing on the presence and distribution of pre-Columbian treponemal disease in the Old World (Kennedy, 1990; Vasulu, 1994). In this report, we describe previously unstudied remains from one such site, dating to the first or second century B.C., that display skeletal evidence of treponematosis.

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Address reprint requests to Dr. T.S. Vasulu, AHGU, Indian Statistical Institute, Calcutta 700 035, India.

MATERIALS AND METHODS

The Megalithic site near Agripalle, about 30 km from Vijayawada in Nuziveedu Taluq, Krishna District, Andhra Pradesh, is an extensive cist burial complex on the western foot of the hill Sobhanagiri. It was excavated during 1970–1971 by a team from the State Archeological Survey of Andhra Pradesh, of which V.V.R was a member. The site was identified by the cairn packing in small heaps, which is a characteristic feature of the Megalithic (Iron Age) burial complex. Three types of burial—cist, sarcophagus, and urn—were encountered (Fig. 1). The burials, all of which were secondary and postcremated, were located about 50 m from the foot of the hill. Three cists were found about 2 m apart in an area of about 10^2 m. These were constructed at different levels (depths) and covered by granite slabs on all four sides. Two of these—Cist I (upper) and Cist II (lower)—contained a few calcined human bones together with redware pots and iron implements. The Cist II (lower) burial included the remains of four skulls (1, 2, 3, 4) associated with isolated teeth, broken pieces of long bones, and fragmentary ribs and vertebrae. The archeological assemblage from the site and the associated skeletal material are briefly described in Table 1.

Dating of the site was based on the archeological evidence. The cairn packing, cist and urn burial complexes, and associated redware ceramics and iron implements suffice to date the site to the late Iron Age period, ca. first to second centuries B.C. (Deo, 1973; Kennedy, 1975; Lukacs, 1981; Kennedy and Caldwell, 1984). The Agripalle site is linked by cultural affinities and geographical proximity to the better known Megalithic sites of Yelleswaram and Nagarjunakonda (Gupta and Dutta, 1962; Subramanyam, 1975) (Fig. 1).

Skull 1 from the Cist II (lower) burial is nearly complete but lacks the mandible. It exhibits prominent, blunt coronal, sagittal, and lamboidal sutures with irregular pitting and fusion. The degree of sutural fusion (extending over the C^2, S^1, L^1, and L^2 zones of the respective sutures), the thickness of the cranial vault, the prominent brow ridges, the rectangular orbits, and the surface rugosities and overall physiognomy of the cranium suggest that the person was an adult male about 50 years old at the time of death. Differential diagnosis (described in the concluding discussion below) and systematic comparisons with the skeletal series of Calvin (1964), Steinbock (1976), and Ortner and Putschar (1981) strongly suggest the presence of advanced treponemal infection.

DESCRIPTION OF THE SPECIMEN

In a frontal view (Fig. 2), Skull 1 exhibits extensive erosion of the frontal and orbital regions, destruction of the nasal septum and palate, perforation of the maxillary sinus, and alveolar damage. The frontoparietal region displays extensive cortical destruction and irregular osteitic and periosteitic lesions that give an appearance of stellate scars. This is most pronounced on the left side, which has a distinctly granulomatous appearance of nodular foci with intermittent porosity, possibly due to the healing of gummatous lesions involving the cortex and diploe of the calvarium. A similarly porous healed surface is seen in the naso-orbital region near glabella (Fig. 2). The margins of the nasal aperture appear well formed and extended (widened); but there is osteosclerotic thickening of the bone on the left lower curvature, possibly betokening a healed lesion, and the right lower nasal margin shows cortical destruction. The nasal spine is completely destroyed, together with the adjoining part of the hard palate. Similar multiple foci of perforation and cortical destruction are also seen on the orbital plate of the ethmoid, the lacrimal, the frontal process of the maxilla, the orbital surface of the greater wing of the sphenoid, and the frontal process of the zygomatic. Severe erosion is also seen on the palatine and on the inner surface of the right maxillary sinus. The left maxilla exhibits smooth thickening of the bony edges of the ulcerated perforations. Eroded areas of sclerotic diploe and deep ulcerations cover almost the entire upper part of the occipital region, disfiguring the lamboidal suture (Fig. 3). On the left lateral aspect, white, porous clumps of irregular remodeled bone appear. Below the lamboidal suture, the erosion is less severe.

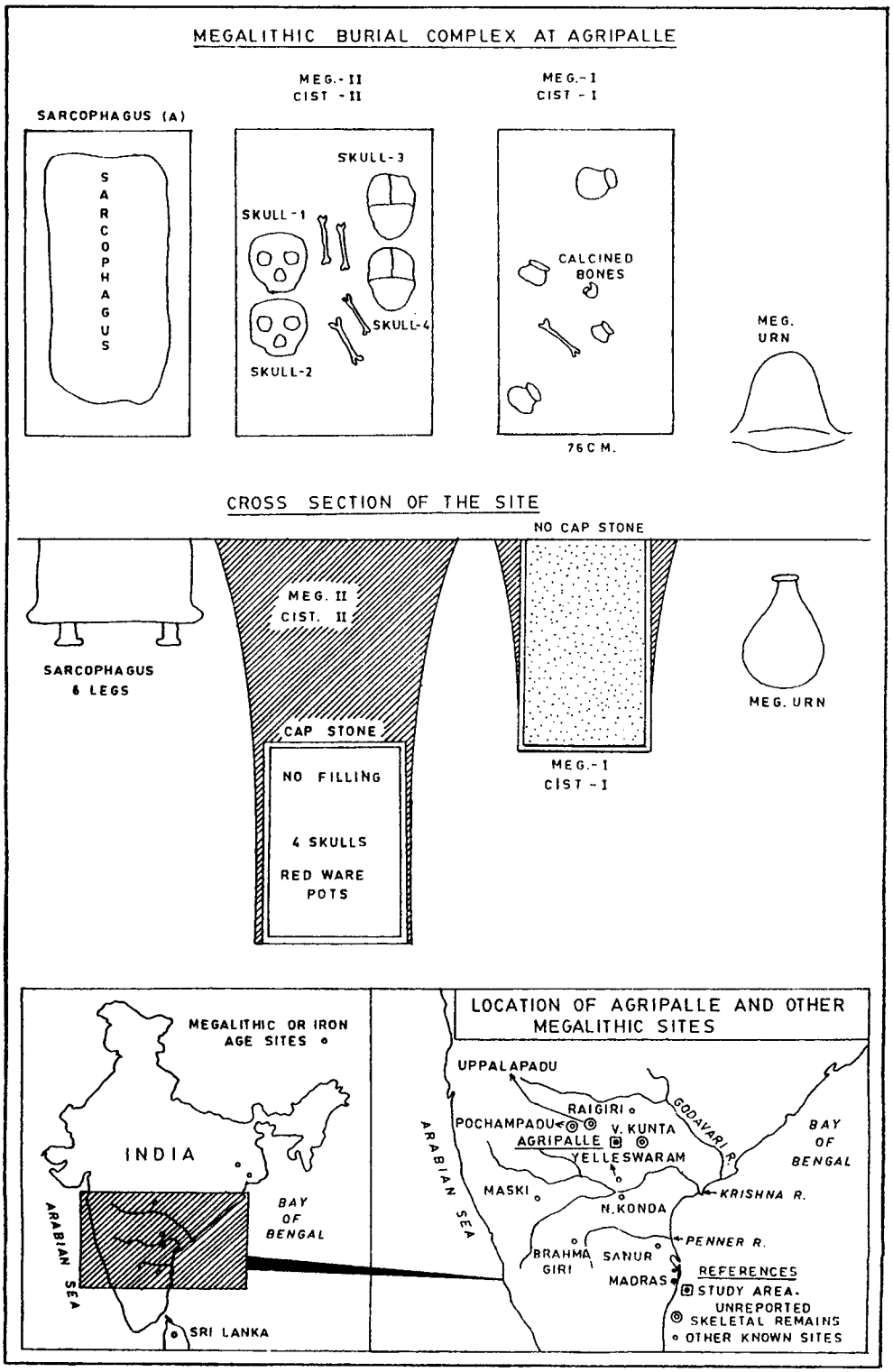

Fig. 1. Plan and cross section of the Agripalle site; location of Agripalle and other neighboring Megalithic sites.

TABLE 1. Skeletal finds from Agripalle and their cultural context

Type of burial	Description	Cultural association	Skeletal remains
Cist I Secondary	Rectangular granite slab, no cap stone, floor granite, filled red alluvial soil (1.80 × 0.76 × 1.15 m).	Redware, globular pot, vase, iron implement	Charred bones
Cist II Secondary	Rectangular granite slab, cap stone, granite floor, not filled (1.45 × 0.80 × 1.45 m). Located at the floor level of Cist I (depth about 2 m).	Redware pot, bowl, lid with bowl	Four skulls (one male, one female), two sets of femur, fibula, ulna, radius, ribs, few teeth and vertebrae
Cist III Secondary	Rectangular granite slab (3.20 × 0.55 × 1.50 m).	Black redware bowl	Calcined bones
Sarcophagus A Secondary	Rectangular, terra cotta with six legs (1.37 × 0.45 × 0.45) m.	—	Calcined bones embedded in red soil
Sarcophagus B Secondary	Rectangular, terra cotta with six legs, depth 0.15 m (1.12 × 0.45 × 0.50) m.	Three black redware pots	—
Urn A and urn B	Globular in shape, depth 0.40 m.	—	Few charred bones

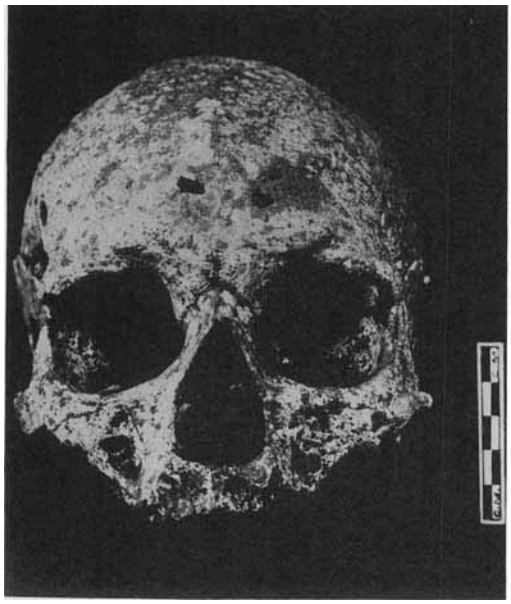

Fig. 2. Frontal view of Skull 1 from the Cist II (lower) burial, showing a granulomatous appearance of nodular foci with localized porosity of the frontal. Scale in cm.

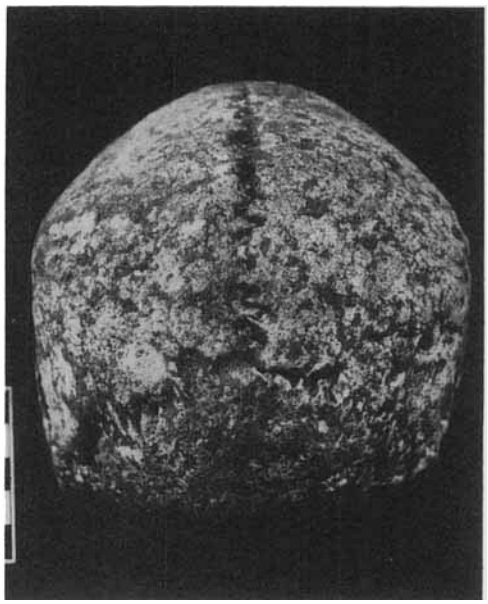

Fig. 3. The occipital region of Skull 1, showing eroded areas of sclerotic diploe, deep ulcerations, stellate scars, and destruction and disfiguring of the lamboidal sutures. White patches of remodeled bone are evident above the left lateral lamboidal suture. Scale in cm.

The right lateral aspect of the calvarium shows areas of bone remodeling in the parietal region, with active lesions toward the occipital end. There is extensive superficial erosion in the right temporal region, but no signs of remodeling (Fig. 4). The erosion in this area is therefore probably due to post-mortem damage. There are three fresh-looking, sharp-edged perforations in the frontal bone near the midsagittal plane (Fig. 1). One of the three holes is surrounded by a rough, thin zone of extensive cortical destruction

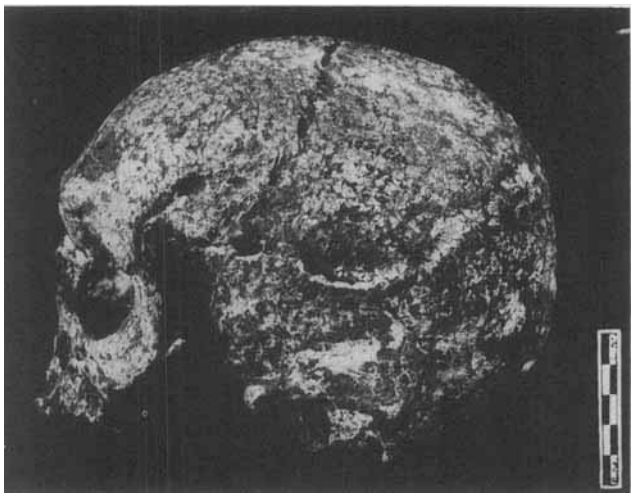

Fig. 4. Temporal region of Skull 1, exhibiting fewer destructive lesions. Extensive superficial erosion with no signs of remodeling, probably due to postmortem damage, has obscured the original surface features. Scale in cm.

with no sign of bone reaction or remodeling. We conclude that these perforations and the nonreactive eroded area also resulted from postmortem damage, perhaps produced by funerary practices carried out before the skull was reburied in the cist.

Overall, the calvarium shows extensive destruction of cortical bone with irregular patches of redeposition, especially pronounced in the frontoparietal region. Active zones of erosion and deep cavitation cover almost the entire external surface. By contrast, the inner table is virtually intact (apart from the three frontal perforations).

DISCUSSION

The lesions of treponematosis are not always easy to distinguish from those caused by anemia, osteomyelitis, rickets, leprosy, and other diseases that affect bone, especially in dealing with damaged or fragmentary skeletons. The diagnostic characteristics of treponematosis, established by Calvin (1964), Steinbock (1976), and Ortner and Putschar (1981), chiefly involve the outer table of the cranium. In advanced stages of disease, they include extensive erosion and gummatous destruction of the outer table, extending into the diploe and accompanied by patches of perifocal reactive bone formation due to periosteal sclerosis. This reactive bone has a partly smooth, partly hypervascular surface which looks folded or wrinkled, or gives an appearance of stellate scars. It is seen most frequently in the frontal and nasopalatine regions, sometimes extending to the maxilla, the inside of the orbit, and the parietal region, and less frequently in the temporal and occiput (below lambda) regions. Lesions of the sternum and of the tibia and other long bones are also common. These diagnostic signs distinguish treponematosis from other diseases affecting bone. In osteomyelitis, the bones of the skull rarely exhibit lesions, and those of the face and jaws are never involved (Oliver, 1957). Leprosy may produce similar erosion of the nasal bones, the hard palate, and the maxilla, but the periosteal bone reactions that produce porous and stellate scars are not expected. Severe anemia may produce porotic hyperostosis attended by ulceration and deep lesions of the bone, but it is not attended by the deep cavitation, necrotic gummatous destruction, and extensive bone remodeling that characterize treponematosis. The lesions produced by osteosarcoma (which typically affects younger age groups and is usually confined to a particular bone) and by tubercular infections of bone (which typically begin in the

inner table of the cranial vault) are likewise readily distinguishable from treponemal bone lesions.

All the pathological changes observed in Skull 1 from the Agripalle site are compatible with a diagnosis of treponematosis. The diagnosis is complicated by postmortem erosion of the outer table of the skull, which has obscured the evidence of antemortem destruction in some areas (particularly in the right temporal region). However, the smooth, shining surface of the masses of redeposited bone in the occipital and frontoparietal regions attests to a generally negligible level of postmortem erosion, typical for cist burials in this part of India. Although the cortical erosion and deep ulcerated pitting found along the cranial sutures of Skull 1 are not typical of treponematosis, such sutural lesions are sometimes encountered in cases of advanced syphilis (cf. Steinbock, 1976, Fig. 52B; Ortner and Putschar, 1981, Figs. 316, 341).

Unfortunately, the other skeletal elements (long bones) found with Skull 1 are too fragmentary to add any useful diagnostic information. It is worth noting that two parietal fragments (Skull 2) from the cist, probably representing a female individual, display similar patches of surface erosion and redeposited bone, suggesting infection by the same pathogen that produced the lesions observed in Skull 1. The other two fragmentary skulls (3 and 4) from the same cist burial, however, show no such lesions.

At least two other possible cases of pre-Columbian treponematosis have been described from India. An occipital bone of an 8-year-old child recovered from a Chalcolithic site at Inamgaon (1000–700 B.C.) was tentatively interpreted by Lukacs and Walimbe (1984) as displaying possible symptoms of yaws. Since this was not associated with other skeletal elements, the Inamgaon occipital was considered as tenuous evidence for treponematosis by Baker and Armelagos (1988). However, more convincing evidence is provided by a cranium (specimen no. 13TF-III-F-16) recovered from an Iron Age (Megalithic) cave deposit at Bhimbetka in Madhya Pradesh. The parietal bone of this cranium displays on its ectocranial surface a depressed area with a thickened border, which has been interpreted by Kennedy (1990) as a lesion produced by cranial yaws. The Bhimbetka cranium furnishes additional evidence for the presence of treponemal infection in India at the time of the Agripalle burials, although the pathologies observed in the Agripalle material are more suggestive of syphilis than of yaws.

If these interpretations are correct, pre-Columbian treponematosis was present in the Old World not only in northern Europe, Iraq, and the Pacific islands (Brothwell, 1968; Baker and Armelagos, 1988), but also in the Indian subcontinent. Our findings contradict the popular theory that treponematosis was first spread outside the Americas by European voyagers in the 16th century, and support the alternative hypothesis that treponemal disease is of considerably greater antiquity in both the Old and New Worlds, possibly dating back to the Paleolithic in both hemispheres (Hudson, 1965; Baker and Armelagos, 1988; Livingstone, 1991). Since the treponemal pathogen apparently originated as a zoonosis (Livingstone, 1991), debate over the origin and history of the disease must shift its focus to the problem of identifying the animal species that furnished the original host population for *Treponema*. Paleopathological investigations of pre-Columbian human remains from the Old World tropics, such as the material from Agripalle described in this report, can be expected to have a decisive bearing on this problem.

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